IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent application of	:	
Leslie Michael LEA et al.	:	Group Art Unit 1763
Serial No. 10/043,265	:	Examiner Alejandro Mulero, Luz
Filed January 14, 2002	:	Confirmation No. 5387

PLASMA PROCESSING APPARATUS

APPEAL BRIEF

U.S. Patent and Trademark Office
"eFILING"
Randolph Building
401 Dulany Street
Alexandria, VA 22314

Sir:

In connection with the above-identified application, please enter this Appeal Brief is in support of Applicant's appeal before the Board of Patent Appeals and Interferences.

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REAL PARTY IN INTEREST

The real party in interest is the assignee of record of the application, namely, Surface Technology Systems plc, located at Imperial Park, Newport, Gwent, United Kingdom.

RELATED APPEALS AND INTERFERENCES

There are no prior or pending appeals, judicial proceedings or interferences known to the Appellant which may be related to, directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

STATUS OF CLAIMS

Claims 1-37 are pending in the application.

Claims 12-20, 22 and 24-37 have been withdrawn from consideration[1].

No claims have been cancelled.

Claims 1-11 and 21 are the claims appealed[2].

[1] Dependent claims 12-13 and 15-17 depend directly or indirectly from claim 1, and it is understood that these dependent claims would be allowed upon the eventual allowance of claim 1.

[2] Rejected independent claim 23 has been excluded from the appeal without prejudice or disclaimer of its subject matter. Applicants reserve all rights to further prosecute the subject matter of this claim via one or more continuing applications.

STATUS OF AMENDMENTS

There have been no amendments to the appealed claims filed subsequent to final rejection.

SUMMARY OF CLAIMED SUBJECT MATTER[3]

The invention of appealed claim 1 is directed to a plasma processing apparatus which includes a first chamber, a second chamber and a magnetic field production device. That is, referring to the example of FIG. 18, the illustrated plasma processing apparatus includes a first chamber A and a second chamber B. *Page 37, lines 7-9.* The first chamber A is provided with a plasma inducing device (RF source 21 and antenna 10) designed to produce a plasma in the first chamber A. *Paragraph bridging pages 39-40.* The produced plasma is diffused in the second chamber B to act upon a workpiece 1 being processed in the second chamber B. *Page 37, lines 7-10.* Still referring to the example of FIG. 18., the illustrated plasma processing apparatus further includes a magnetic field production device 8 (permanent or electromagnet) and/or 18 (solenoid) which is separate from the plasma inducing device 21/10. The magnetic field production device 8/18 is positioned to act on the first chamber A, is located either adjacent to the first chamber A or between the first and second chamber B, and is constructed to cause attenuation of the ions which diffuse into the second chamber and approach the workpiece, by directing a proportion of the ions to a loss surface of either chamber A and B. *Page 44, lines 9-17, and paragraph bridging pages 45-46.*

Still referring to the example of FIG. 18, according to appealed dependent claim 2, the magnetic field production device includes permanent magnets or electromagnets 8 installed around the side wall of the first chamber A.. *Page 44, lines 9-17.*

Still referring to the example of FIG. 18., according to appealed dependent claim 3, the magnetic field production device is around the first chamber A and is a solenoid 18 whose output can be varied. *Page 44, lines 9-17.*

Referring to the example of FIG. 25, according to appealed dependent claim 4,

[3] All page and line designations refer to the substitute specification of record.

the apparatus incorporates an additional plasma (gas ring 16 and antenna 24) inducing device at the upper region of the second chamber B. *Paragraph bridging pages 52-53.*

Referring to the example of FIG. 25, according to appealed dependent claim 5, permanent magnets, electromagnets or a solenoid are installed around the additional plasma inducing device 16/24 at the upper region of the second chamber B, as a further magnetic field production device. *Page 52, lines 9-12.*

Referring again to the example of FIG. 18, according to appealed dependent claim 6, the magnetic field production device includes a magnetic structure 8 formed at the junction of the two chambers A and B to create a dipole magnetic field there. *Page 44, lines 9-17.*

Referring still to the example of FIG. 18, according to appealed dependent claim 7, the apparatus incorporates a ring gas feed 16 within the second chamber A, below the junction point of the two chambers A and B, in addition to a gas feed inlet 14 to the top of the first chamber A. *Page 52, lines 13-18.*

Referring to the example of FIG. 18, according to appealed dependent claim 8, a solenoid device whose output can be varied is provided for the second chamber B at a position to create a magnetic field inside the second chamber B at the level of the workpiece 1 to steer ions towards the workpiece 1. *Page 39, lines 8-15.*

Referring to the example of FIG. 19, according to appealed dependent claim 9, the second chamber B is provided with a magnetic bucket arrangement created by an array of magnets 21 around the wall of the chamber B. *Page 47, lines 9-12.*

Referring to the examples of FIGS. 18 and 20A~20C, according to appealed dependent claim 10, the first chamber A geometry is formed as a cylinder, a stepped

cylinder, a cone, a truncated cone, or a hemisphere, or a combination of these geometries. *Page 16, lines 17-19, and paragraph bridging pages 39 and 40.*

Referring to the example of FIG. 26, according to appealed dependent claim 11, the first chamber A is of annular form and an annular magnetic field production device includes separate permanent magnets, electromagnets or solenoids 181 and 182 located both within and around the first chamber A. *Page 54, lines 5-17.*

Referring to the example of FIG. 18, according to appealed dependent claim 21, the first chamber A incorporates a dielectric plasma tube 11 formed from aluminium nitride or silicon carbide or other dielectric material having a thermal conductivity sufficiently greater than aluminium oxide to allow high power operation without failure inducing high thermal gradients arising in the dielectric material. *Page 40, lines 7-23.*

GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

The grounds of rejection presented for review on appeal are as follows:

Claim(s)	*Rejection*	*Reference(s)*
1, 3, 6-7 and 9-11	§102	Campbell et al. (US 4990229)
1, 3, 7-8 and 10	§102	Maeda et al. (EP 0676793 A2)
1, 2 and 10	§102	Boswell (US 4810935)
2 and 8	§103	Campbell et al. in view of Yokota (JP 7-153594)
4-5	§103	Campbell et al. in view of Takagi (US 5681393) or Ishii et al. (US 5529657)
21	§103	Campbell et al. in view of Wicker et al. (US 5863376)
2	§103	Maeda et al. in view of Yokota
4-5	§103	Maeda et al. in view of Takagi or Ishii et al.
6, 9 and 11	§103	Maeda et al. in view of Campbell et al.
21	§103	Maeda et al. in view of Wicker et al.
3 and 8	§103	Boswell in view of Yokota
4-5	§103	Boswell in view of Takagi
6-7, 9 and 11	§103	Boswell in view of Campbell et al.
21	§103	Boswell in view of Wicker et al.

ARGUMENT

I. GENERAL OBSERVATIONS

Respectfully, the Examiner has not established anticipation of the rejected claims, nor has the Examiner established a *prima facie* case of obviousness of the rejected claims.

While the Examiner does not expressly invoke principles of inherency, it is clear that alleged inherent characteristics of the cited references form the foundation of each rejection. As explained herein, the Examiner has failed to meet the legal burden of establishing inherency to support the rejections.

In addition, the Examiner has failed to provide sufficient weight to Applicant's submittal of evidence to rebut the (defective) assertions of inherency. Namely, the DECLARATION OF DR. LESLIE LEA UNDER 37 C.F.R. ¶1.132 ("the Lea Declaration") directly rebuts the Examiner's alleged inherent characteristics of the cited references.

When faced with the evidence put forth by the Lea Declaration, the Examiner's seems to alter the basis for the rejection by alleging that certain claim limitations are not afforded patentable weight as being "mere intend use". So, the rejections of record appear to rely on principles of inherency to reject the claims, and then, in contradistinction, on principles of intended use to discount the Lea Declaration. This mid-stream change in the foundation for the rejections is not sufficient to establish anticipation of the rejected claims, nor is it sufficient to establish a *prima facie* case of obviousness of the rejected claims.

II. THE INVENTION OF THE APPEALED CLAIMS

Among other limitations, independent claim 1 recites:

> "[a] magnetic field production device is positioned to act on the first chamber, is located either adjacent to the first chamber or between the first and second chambers and is

constructed **to cause attenuation of the ions which diffuse into the second chamber and approach the workpiece, by directing a proportion of the ions to a loss surface of either chamber**."

The Board's attention is respectfully directed to FIG. 21 of the present application. A solenoidal magnetic field generated by a coil 18 around the upper chamber A, has advantages as a "magnetic plasma attenuator. By adjustment of the magnetic field strength, a dense plasma region 19 formed inside the tube 11 and adjacent to the antenna 10 is at least partially trapped by the field lines 20. These field lines intersect the wall of the upper chamber A near, and either on the upper chamber wall near its base, or upper walls of the lower chamber B. Significant numbers of radicals can be created in the upper chamber A, which then diffuse into the lower chamber. **The associated ion flux is reduced, however, because of losses where the field lines intersect the walls, thereby ensuring that the ratio of ion numbers to radical numbers reaching the wafer is reduced in line with requirements.** As stated by Lea in his Declaration, "one aim of the present invention is to reduce the number of ions that reach the wafer (to be processed) from a plasma source while allowing the majority of radicals (carrying no charge) from the plasma source to reach the wafer. The effect is to reduce the ratio of numbers of ions to radicals in the region of the wafer from that found in the plasma source."

As explained below, the cited references individually and in combination do not teach or suggest a magnetic field production device positioned to act on a first chamber, located either adjacent to the first chamber or between the first chamber and a second chamber and constructed to cause attenuation of the ions which diffuse into the second chamber and approach the workpiece, by directing a proportion of the ions to a loss surface of either chamber.

III. THE REJECTIONS UNDER 35 U.S.C. §102

Claims 1, 3, 6-7 and 9-11 stand rejected under 35 U.S.C. §102 as being anticipated by Campbell et al. (US 4990229). Claims 1, 3, 7-8 and 10 stand rejected under 35 U.S.C. §102 as being anticipated by Maeda et al. (EP 0676793 A2). Claims 1, 2 and 10 stand rejected under 35 U.S.C. §102 as being anticipated by Maeda et al. (EP 0676793 A2). Reversal of these rejections is requested.

Each of the rejections under 35 U.S.C. §102 is predicated upon the Examiner's unsubstantiated assertion as follows:

> "It should be noted that attenuation of the ions which diffuse into the second chamber and approach the workpiece, by directing a proportion of the ions to a loss surface of either chamber will be produced."

Nowhere does the record provide support for the Examiner's assertion.

Further, the Board's attention is respectfully directed the following passages from M.P.E.P. §2112:

> "The fact that a certain result or characteristic may occur or be present in the prior art is not sufficient to establish the inherency of that result or characteristic. *In re Rijckaert*, 9 F.3d 1531, 1534, 28 USPQ2d 1955, 1957 (Fed. Cir. 1993) (reversed rejection because inherency was based on what would result due to optimization of conditions, not what was necessarily present in the prior art); *In re Oelrich*, 666 F.2d 578, 581-82, 212 USPQ 323, 326 (CCPA 1981). "To establish inherency, the extrinsic evidence 'must make clear that the missing descriptive matter is **necessarily present** in the thing described in the reference, and that it would be so recognized by persons of ordinary skill. **Inherency, however, may not be**

> **established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient.**"
>
> "In relying upon the theory of inherency, the examiner must provide a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic **necessarily flows** from the teachings of the applied prior art." (Emphasis added.)

The rejections of record are entirely devoid any basis in fact and/or technical reasoning to support that Examiner apparent contention that the subject limitation of the present claims is somehow inherent in the cited references.

Rather, relying on alleged similarities with Applicant's own disclosure, the Examiner simply contends that "one of ordinary skill in the art ... ***would have expected*** attenuation of the ions by the magnetic field production device 8 of the apparatus of the Campbell et al. reference."

The "would-have-expected" standard adopted by the Examiner falls **far short** of the "necessarily flows" requirement long-mandated by the Patent Office and federal case law.

Further, Applicants have submitted **evidence** in the record which demonstrates that the subject limitations of the claims are not inherent in the cited references, namely, the DECLARATION OF DR. LESLIE LEA UNDER 37 C.F.R. ¶1.132 ("the Lea Declaration") already of record.

As described at paragraph 4 of the Lea Declaration, each of Campbell et al., Maeda et al., and Boswell describe helicon type plasma sources which aim to increase the efficiency of energy transfer from the RF power supply to the plasma, i.e., to increase plasma (ion and electron) density.

Helicon type plasma sources such as those of the cited references achieve a result

which is **opposite** to that attributed by the Examiner.

The Examiner dismisses the Lea Declaration by abandoning the previous assertions of inherency and alleging that limitations of independent claim 1 as *"mere intended use"* – and thus the Examiner seems to say that the subject limitations of claim 1 are entitled no patentable weight. This position of the Examiner is clearly erroneous.

Claim 1 recites in part:

> **the magnetic field production device** is positioned to act on the first chamber, is located either adjacent to the first chamber or between the first and second chambers and is **constructed to cause attenuation of the ions which diffuse into the second chamber and approach the workpiece, by directing a proportion of the ions to a loss surface of either chamber.**

Claim 1 does **not** recite a mere intended use, and instead clearly recites a magnetic field production device constructed to cause attention of ions as claimed. **The cited Campbell et al., Maeda et al., and Boswell reference are all devoid of a magnetic field production device constructed in such a manner**, and for at least this reasons, Applicants respectfully request reversal of the rejections of claims 1-3 and 6-11 under 35 U.S.C. §102.

IV. THE REJECTIONS UNDER 35 U.S.C. §103

Several of the dependent claims were variously rejected under 35 U.S.C. §103 as being unpatentable over Campbell et al. or Maeda et al. or Boswell, in combination with various secondary references cited by the Examiner at pages 6-14 of the Office Action. However, Applicants respectfully request reversal of these rejections for at least the same reasons as stated above in connection the rejections under 35 U.S.C. §102.

V. CONCLUSION

For at least the reasons given herein, Appellant respectfully contends that the

Examiner has not established anticipation and a *prima facie* case of obviousness, and that the appealed claims define over the teachings of the applied references.

Reversal of each of the rejections of record is respectfully requested.

Respectfully submitted,

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CLAIMS APPENDIX

1. A plasma processing apparatus comprising a first chamber provided with a plasma inducing device designed to produce a plasma in said first chamber, and a second chamber into which plasma so produced can diffuse to act upon a workpiece being processed, and a magnetic field production device which is separate from the plasma inducing device, wherein the magnetic field production device is positioned to act on the first chamber, is located either adjacent to the first chamber or between the first and second chambers and is constructed to cause attenuation of the ions which diffuse into the second chamber and approach the workpiece, by directing a proportion of the ions to a loss surface of either chamber.

2. Apparatus according to claim 1, wherein the magnetic field production device comprises permanent magnets or electromagnets installed around the side wall of the first chamber.

3. Apparatus according to claim 1, wherein the magnetic field production device around the first chamber is a solenoid whose output can be varied.

4. Apparatus according to claim 1 and incorporating an additional plasma inducing device at the upper region of the second chamber.

5. Apparatus according to claim 4, wherein permanent magnets, electromagnets or a solenoid are installed also around said additional plasma inducing device at the upper region of the second chamber, as a further magnetic field production device.

6. Apparatus according to claim 1, wherein the magnetic field production device comprises a magnetic structure formed at the junction of the two chambers to create a dipole magnetic field there.

7. Apparatus according to claim 1, and incorporating a ring gas feed within the second chamber, below the junction point of the two chambers, in addition to a gas feed inlet to the top of the first chamber.

8. Apparatus according to claim 1, wherein a solenoid device whose output can be varied is provided for the second chamber at a position to create a magnetic field inside the second chamber at the level of the workpiece to steer ions towards the workpiece.

9. Apparatus according to claim 1, wherein the second chamber is provided with a magnetic bucket arrangement created by an array of magnets around the chamber wall.

10. Apparatus according to claim 1, wherein the first chamber geometry is formed as a cylinder, a stepped cylinder, a cone, a truncated cone, or a hemisphere, or a combination of these geometries.

11. Apparatus according to claim 1, wherein the first chamber is of annular form and the annular magnetic field production device comprises separate permanent magnets, electromagnets or solenoids located both within and around said first chamber.

21. Apparatus according to claim 1, wherein said first chamber incorporates a dielectric plasma tube formed from aluminium nitride or silicon carbide or other dielectric material having a thermal conductivity sufficiently greater than aluminium oxide to allow high power operation without failure inducing high thermal gradients arising in the dielectric material.

EVIDENCE APPENDIX

1. DECLARATION OF DR. LESLIE LEA UNDER 37 C.F.R. ¶1.132, dated January 5, 2006, a copy of which is submitted separately herewith.

RELATED PROCEEDINGS APPENDIX

[There are no related proceedings.]